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Dr. LEE, President, in the Chair.

S. H. Miller, Esq., Wisbeach;
Rev. J. E. Cross, Appleby, near Brigg, Lincolnshire; and
John Newton, Esq., Well Street,

were balloted for and duly elected Fellows of the Society.

J. S. S. Glennie, Esq., was balloted for and re-elected a Fellow of the Society.

Announcement of New Instruments about to be supplied by Government to the Great Trigonometrical Survey of India. By Lieut.-Colonel A. Strange.

It may interest the Society to be informed that the more purely scientific operations of the Great Trigonometrical Survey of India are about to receive an impulse by the addition of several important Instruments, namely,—

1 Great Theodolite, with a 3-feet Horizontal Circle.
2 Zenith Sectors.
3 Transit Instruments.
3 Astronomical Clocks.
3 Galvanic Registers.

Negotiations for the supply of these Instruments are now in progress, and the Secretary of State for India in Council has done me the honour to intrust the superintendence of their construction to me.

I have been engaged for a considerable period in preparing the design for the Great Theodolite, the working drawings of which, in nine large sheets, and a voluminous specification, are now completed, and embrace the most minute details. Though

based on brief notes by Sir Andrew Scott Waugh, the late Surveyor-General of India, and practically carried out by me, this design comprehends the suggestions of many minds. The endeavour has been to engraft on the excellencies of existing theodolites of the first class, all that the experience of thirty years or more has shown to be desirable, and modern science has rendered possible of achievement, for increasing the power, efficiency, and convenience of the new Instrument. It will present some features of novelty and value sufficient perhaps from time to time to engage the interest of the Society.

The form, size, and arrangements of the other Instruments above enumerated, are still under consideration.

Major J. T. Walker, of H. M. Indian Engineers, the present able Superintendent of the Great Trigonometrical Survey, proposes to employ the Zenith Sectors for adding to the number of points on the Great Meridional Arc of India, the latitudes whereof have been astronomically determined. At present there exist in the northern and more modern portion of this Arc, executed by Sir George Everest, only three such points in an extent of 11° 28′, subdividing the entire Arc into two sections whose amplitudes are respectively 5° 24′ and 6° 4′. Sir Henry James, Superintendent of the Ordnance Survey of Great Britain, suggests that an observed latitude at every degree "would have added very greatly to the weight of the determination of the Earth's figure, and would, besides, have thrown much light upon the question of Himalayan influence." The same object will probably lead Major Walker to use these instruments wherever facilities for doing so profitably are afforded by the extensive and accurate triangulation now spread over a large portion of the Indian peninsula.

The Transit Instruments, Clocks, and Galvanic apparatus, are intended for the determination of longitudes by Electric Telegraph. Major Walker expressly points to the possibility, at no distant date, when certain telegraphic lines now in progress are completed, of ascertaining the absolute difference of Longitude between Greenwich and Kurrachee in Scinde, and thence the true Longitude of every point in India fixed by the Great Triangulation. And he justly observes that "the importance of such a desideratum can scarcely be over-estimated, not only to Science, but also to Navigation, in furnishing the most accurate basis possible for Maritime Charts." This step having been gained, we cannot pause until the Eastern Archipelago, China, and the Australian Colonies, by being linked in the chain, shall cease to present those dangers to seamen which are incident to uncertainty in the longitude.

I may add the hope that the same method will be employed to render available as a geodesic datum the Arc of Parallel*

* This Arc is designated "*The Great Longitudinal Series, Western Section.*" It was commenced in the season 1848–49, and completed 1852–53. The first eighty miles (at the eastern extremity) was executed by Major

lying between Seronj, in Central India, and Kurrachee, in Scinde, comprising about $10\frac{1}{2}$ degrees of longitude, the triangulation of which was executed with the same high class of instrument, and according to the same rigorous system with which Sir George Everest's Great Meridional Arc was measured. It is verified by a Base-line at either extremity, as well as by frequent astronomical determinations of the Azimuth along its course. The character of this work, and its comparative proximity to the Equator (N. latitude about 25°), will constitute it, when completed by the telegraphic observation of the difference of longitude of its extremities and of various points in its length, a valuable accession to the existing meagre array of Arcs of Parallel of the first order.

It is to be regretted that though a chain of triangles connects Seronj in Central India, and Calcutta, and is therefore nominally a continuation of the Arc of Parallel just referred to, this Eastern section cannot properly be combined with the Western for geodesic purposes. In speaking of this work, Sir Andrew Waugh, whilst giving Mr. Olliver, by whom it was executed, full credit "for his indefatigable exertions under difficult circumstances," adds that, "on account of the defective state of instrumental equipments, the professional value of the work is only of a secondary or tertiary order."* The work was carried on during the absence in Europe of Sir George Everest, then Surveyor-General, prior to the introduction of his admirably organised system, and in days when the supply of superior instruments was not so readily conceded as it since has been. In order to place the Eastern on a par with the Western section, the entire triangulation of the former must be executed *de novo* in the modern style and with appropriate apparatus. The line crosses an insalubrious and difficult tract, it is true, but no work of this kind is free from great obstacles. It is to be hoped that, as the terminal Base-lines at Calcutta and Seronj respectively, which constitute so important and costly a branch of such undertakings, are already measured, and as the Western section is complete, the revision of the Eastern section may eventually be justified by the consideration that the two sections combined will confer on mathematical science a contribution so magnificent as that of a continuous Arc of Parallel of the first order, 21 degrees in length.

London, 13th May, 1862.

Renny Tailyour, Bengal Engineers, and the rest by me. This work constitutes, perhaps, the first example of a true Desert being successfully traversed by a great triangulation.

* Return to the House of Commons, Trigonometrical Survey, India, 15th April, 1851, pp. 5, 6.

Transit of Titan's Shadow across the Disk of Saturn, on 15th April, 1862. By the Rev. W. R. Dawes.

The sixth satellite of *Saturn* (*Titan*) passed its inferior conjunction with the planet on the night of April 15th, and soon afterwards the shadow of the same satellite transited the disk of *Saturn*.

At $10^h\ 31^m$ G.M.T. *Titan* was judged to be at its nearest approach to the planet's north pole. The air was not in a sufficiently good state to render of any use a higher power than 300 on my $8\frac{1}{4}$-inch refractor. With this, the best views showed the satellite quite round, and in loose contact with the disk; but conveying the impression that if the air had been perfectly pure and quiet, a very slight separation might perhaps have been discerned.

Soon after 11^h (time not precisely noted), a shallow circular notch was cut out on the eastern edge of the disk, about one second or a second and a half to the north of the edge of the ring at that place.

At $11^h\ 8^m$, the shadow was judged to have entered one-half its own diameter, the semicircular notch appearing of very considerable size.

At $11^h\ 14^m$, the internal contact was noted; and, in less than half a minute afterwards, the edge of the planet's disk was perceived as a most delicate line of light. The state of the air had improved at this time, and definition with the power then in use (296) was frequently very sharp and steady.

Soon after this, I applied the parallel-wire micrometer, intending to measure the distance between the courses described by the satellite and its shadow, in the direction perpendicular to the axis-major of the ring; but inadvertently the webs were set parallel to the *Earth's* equator instead of *Saturn's*. The mean of six very good measures (with power 286) gave this distance (or *difference of declination*) $= 6''{\cdot}84$. Taking the inclination of the semi-axis-minor of the ring to the circle of declination at $5^\circ\ 12'$, as given in the Table on page 485 of the *Nautical Almanac* for the present year, this difference of declination becomes $7''{\cdot}83$, as measured in the direction *perpendicular* to the axis-major of the ring.

The mean of twelve measures of the *difference of right ascension* of the satellite and its shadow, gave $11''{\cdot}24$; which, reduced in a similar manner, becomes $10''{\cdot}58$ for the distance in the direction *parallel* to the axis-major of the ring.

The shadow passed along the southern edge of the northern equatoreal belt, encroaching on the belt by nearly one-third of its own diameter.

At $13^h\ 46^m$, the shadow was judged to be precisely in the middle of the chord it described; and this was tested by the webs of the micrometer, which had been previously separated

to a distance equal to the equatoreal semi-diameter of *Saturn;* and each web being placed alternately on the shadow by the quick slipping-piece attached to the driving cylinder, the webs were found to measure equally well both the eastern and western side of the disk.

After the shadow had passed the middle of its transit, I took eight measures of the distance between the satellite and its shadow in the direction parallel to the axis-major of the ring, the mean of which was $10''{\cdot}89$. But the state of the air had by this time greatly deteriorated, and the planet was between four and five hours west of the meridian. I therefore prefer the result of the calculation given above, namely, $10''{\cdot}58$.

On the 2d of November, 1789, a similar phenomenon was observed by Sir W. Herschel. He gives the time when he "discovered a black spot on the following margin of the disk of the planet." But this might probably be some minutes after the centre of the shadow coincided with the edge of the disk. Sir William gives $2^h\ 8^m\ 51^s$ as the time which elapsed between his discovery of the spot and its attaining a central position on the disk. The interval between the bisection of the shadow by the limb and its central situation in my observation was $2^h\ 38^m$. The part of the disk transited was nearly the same on both occasions.

I am not acquainted with any other observations of this interesting phenomenon. In the years 1848 and 1849, when the Sun was nearly in the plane of the ring, I looked out diligently for the transits of *Titan* and its shadow; but either from clouds, or the transit occurring in daylight or when the planet was below the horizon, I was never able to observe it; nor have I heard of any other observer who was more fortunate. During the present apparition of the planet also, I have, until the recent occasion, in vain watched for the occurrence of the phenomenon. It will occur again on May 1st and 17th; but I believe that on both those occasions the shadow will be hidden from our view by the interposition of the ring. On the 1st, the path of the shadow will lie within $1''$ to the north of *Saturn's* equator; and on the 17th it will fall on the ring itself, which, from its extremely feeble illumination, will appear as a very dark line across the planet; and it seems exceedingly doubtful whether the shadow, notwithstanding its intense blackness, will be at all discernible upon it.

The *size* of the shadow, however, is far greater than I was prepared to expect. I carefully estimated it at little less than $1''$ in diameter — certainly not less than $0''{\cdot}8$. It may reasonably be concluded from this that some part of the surface of the satellite is not very reflective; and that, with a large amount of optical power, it might perhaps be perceived as a *dark spot* on the disk of the planet (as is *always* the case with the third and fourth satellites of *Jupiter*), especially if

it should happen in its transit to be projected on the bright equatoreal region. This, however, will not occur during the present season; for though, on August 5th, *Titan* will transit the northern portion of that region, yet it will occur while daylight is so strong as to render it utterly improbable that the satellite could be seen on the disk at all, and very unlikely that even its shadow should be detected.

The third transit of the shadow from the present time will occur on the evening of June 2d; and as it will then fall on the *south* side of the ring, it may probably be seen passing along the southern edge of the extremely narrow *shadow of the ring;* and as its ingress will not take place till about fifty minutes after sunset, and the planet will be only about $2\frac{1}{2}$ hours west of the meridian, it is hoped that the phenomenon will be extensively observed, if the sky should be clear.

The following will be approximately the times of the ingress of *Titan's* shadow for the next seven transits; but the strong daylight and the planet's distance from the meridian will combine to render the last two or three of them very difficult to observe, if not absolutely invisible.

Approximate G.M.T. of Ingress of the Shadow of *Titan*.

	h	m
1862, May 1, at	10	24
17,	9	41
June 2,	8	57
18,	8	14
July 4,	7	30
20,	6	47
Aug. 5,	6	3

From the great size of the shadow, I believe that the ordinary aperture of a 5-foot refractor ($3\frac{3}{4}$ to 4 inches) would suffice to show it under favourable circumstances of atmospheric purity and altitude of the planet, provided the defining power of the instrument is extremely good.

Hopefield Observatory, Haddenham, near Thame,
1862, *April* 28.

Transit of Titan's Shadow over the Disk of Saturn, on 1st May, 1862. By the Rev. W. R. Dawes.

Clouds most unfortunately prevented the observation of the transit of the shadow of *Titan* over the disk of *Saturn* on the night of May 1st. A glimpse showed the satellite near its inferior conjunction at $8^h\ 15^m$; but after that the planet re-

mained invisible; and, consequently, I have no means of applying, as I hoped to do, any correction from observation to the calculated time given at the conclusion of my former paper.

Hopefield Observatory, 1862, *May* 3.

In a letter to the Editor, dated 26th May, Mr. Dawes writes that on the 17th he made a capital observation of the transit of *Titan's* shadow; and that on the 25th he watched an *immersion* of that satellite into the *shadow* of *Saturn*.

Transit of Mercury of 11th November, 1861.

(*Extract of a Letter from Charles Todd, Esq., Observatory and Telegraph Department, Adelaide, to the Astronomer Royal, dated* 1861, *Nov.* 26.)

I had a glorious day for observing the transit of *Mercury* on the 12th instant (11th G. T.), with a Dollond of $2\frac{1}{4}^{in}$ aperture.

	h m s	
Total Ingress	2 34 12	A.M.T., very exact.
Egress, int. cont.	6 30 29	A.M.T., rather doubtful; Sun low.
Total Egress	6 32 19	A.M.T., very doubtful; limb boiling; Sun near setting.

Some very fine large clusters of spots on the Sun.

Observations of Comet II. 1861, *made with the Northumberland Equatoreal at the Cambridge Observatory.* By J. C. Adams, Esq., Director of the Observatory.

	G.M.S.T. 1861.	Observed R.A.	Parallax × Δ	Observed N.P.D.	Parallax × Δ
d	h m s	h m s		o ′ ″	
June 30	11 6 7·4	6 40 14·94	+0·127	43 25 37·1	−8·343
	11 19 51·1	6 40 40·50	+0·099	43 19 35·0	−8·391
July 2	10 41 46·6	8 30 28·47	+0·541	...	...
	10 57 47·4	..	..	27 36 40·5	−6·571
3	9 57 55·6	9 39 53·92	+0·822	24 10 11·5	−4·128
	11 4 52·4	9 43 15·42	+0·726	24 4 38·6	−5·330
5	10 29 33·1	11 44 52·88	+0·868	23 38 32·8	−2·301
8	9 54 51·8	13 17 34·82	+0·624	27 54 50·1	−0·573
	10 53 7·9	13 18 22·15	+0·706	27 58 30·1	−1·627
9	11 4 31·9	13 35 4·31	+0·673	29 23 45·7	−1·767
	11 56 10·5	13 35 36·11	+0·709	29 26 47·9	−2·768
10	11 7 1·7	13 47 55·32	+0·641	30 40 45·8	−1·800
13	11 22 27·6	14 13 11·05	+0·588	33 47 49·3	−2·208

		G.M.S.T. 1861.	Observed R.A.	Parallax × Δ.	Observed N.P.D.	Parallax × Δ.
	d	h m s	h m s		° ′ ″	
July	23	10 32 49·0	14 46 40·09	+0·469	39 26 26·8	−2·151
	26	10 32 17·3	14 51 52·27	+0·466	40 27 2·2	−2·369
	27	10 33 40·2	14 53 23·97	+0·469	40 44 52·1	−2·456
	31	10 26 32·3	14 58 53·10	+0·462	41 47 58·5	−2·630
Aug.	1	10 35 45·8	15 0 8·70	+0·473	42 2 10·6	−2·835
	2	10 32 1·3	15 1 21·77	+0·469	42 15 28·0	−2·850
	6	10 6 13·3	15 5 58·48	+0·448	43 3 51·5	−2·718
	8	11 36 5·3	15 8 15·87	+0·508	43 26 28·1	−4·273
	13	10 50 16·2	15 13 38·37	+0·489	44 14 56·1	−3·837
	14	10 5 46·4	15 14 40·53	+0·459	44 23 31·9	−3·202
	15	10 17 49·8	15 15 45·60	+0·470	44 32 18·2	−3·444
	16	10 9 30·0	15 16 49·44	+0·404	44 40 41·4	−3·375
	19	10 29 28·4	15 20 3·57	+0·480	45 4 48·1	−3·860
	20	10 17 53·8	15 21 7·81	+0·474	45 12 18·1	−3·735
	21	9 22 2·6	15 22 10·59	+0·429	45 19 26·2	−2·960
	23	9 45 40·3	15 24 22·39	+0·454	45 33 50·1	−3·414
	24	9 31 49·0	15 25 27·54	+0·443	45 40 36·9	−3·265
	27	10 12 6·3	15 28 50·08	+0·475	46 0 31·3	−4·034
	28	10 12 2·4	15 29 57·85	+0·476	46 6 45·7	−4·088
	30	9 22 4·7	15 32 10·76	+0·445	46 18 33·4	−3·437
Sept.	3	9 57 56·4	15 36 50·93	+0·472	46 40 58·0	−4·183
	6	8 47 24·9	15 40 21·31	+0·427	46 55 58·1	−3·285
	7	9 17 36·4	15 41 35·06	+0·453	47 0 49·0	−3·770
	9	8 45 16·6	15 43 59·40	+0·431	47 10 1·5	−3·394
	10	9 44 31·5	15 45 16·09	+0·470	47 14 35·8	−4·323
	11	9 19 54·9	15 46 29·07	+0·460	47 18 47·9	−3·996
	12	10 24 59·8	15 47 46·77	+0·477	47 23 9·1	−5·047
	13	10 37 13·6	15 49 3·41	+0·475	47 27 11·9	−5·284
	14	9 45 6·2	15 50 16·27	+0·472	47 30 53·2	−4·521
	23	10 12 4·0	16 2 1·87	+0·470	47 59 51·8	−5·342
Oct.	9	9 30 36·3	16 24 25·11	+0·467	48 25 8·7	−5·358
	11	8 57 45·5	16 27 20·63	+0·468	48 25 45·7	−4·935
	12	10 38 55·7	16 28 56·26	+0·429	48 25 51·1	−3·473
	14	9 55 27·1	16 31 52·46	+0·452	48 26 0·1	−5·918
	15	9 14 45·4	16 33 20·43	+0·466	48 25 40·7	−5·342
	16	8 32 50·6	16 34 47·90	+0·467	48 25 22·8	−4·740
	23	8 21 25·1	16 45 33·56	+0·469	48 18 53·2	−4·813
	28	7 35 56·1	16 53 23·50	+0·460	48 10 7·4	−4·290
Nov.	1	7 36 39·0	16 59 49·13	+0·465	48 0 34·7	−4·426
	2	8 57 36·6	17 1 31·62	+0·464	47 57 36·8	−5·698
		9 1 53·1	17 1 32·41	+0·462	47 57 37·9	−5·761
	5	8 3 14·1	17 6 21·53	+0·473	47 48 43·1	−4·959
	6	7 52 51·5	17 7 59·25	+0·473	47 45 28·2	−4·830

		G.M.S.T. 1861.	Observed R.A.	Parallax × Δ.	Observed N.P.D.	Parallax × Δ.
	d	h m s	h m s		° ′ ″	
Nov.	7	8 2 21·5	17 9 38·79	+0·474	47 41 56·1	−5·008
	9	8 43 42·4	17 13 1·20	+0·466	47 34 15·6	−5·721
	11	8 38 55·1	17 16 20·95	+0·465	47 26 31·6	−5·689
	20	6 53 55·6	17 31 30·01	+0·476	46 43 49·4	−4·315
	23	7 49 1·8	17 36 44·66	+0·482	46 26 28·5	−5·327
	27	6 55 5·0	17 43 39·16	+0·485	46 2 18·8	−4·507
	28	6 56 14·3	17 45 24·37	+0·486	45 55 48·9	−4·554
	30	7 58 3·9	17 48 59·05	+0·479	45 42 56·9	−5·575
Dec.	3	7 27 26·7	17 54 16·40	+0·490	45 21 10·9	−5·193
	4	7 55 49·1	17 56 5·36	+0·480	45 13 45·6	−5·653
	5	8 7 48·6	17 57 53·10	+0·472	45 6 8·5	−5·882

The foregoing values were deduced as follows:—

		R.A. Comet — Star.	No. of Comp.	N.P.D. Comet — Star.	No. of Comp.	Star.
	d	m s		′ ″		
June	30	− 6 1·85	1	− 7 37·2	1	*a*
		−11 50·63	1	−31 27·0	1	*b*
July	2	−11 26·54 − 8 10·07	3	..	..	*c* *d*
				+ 5 23·9 − 2 54·2	2	*c* *d*
	3	−28 2·06	1	− 1 49·4	1	*e*
		+ 3 46·57	3	+18 55·2	3	*f*
	5	− 4 25·66	6	−20 23·8	6	*g*
	8	−27 41·47	1	+ 5 53·8	1	*h*
		+ 3 2·19	5	+ 6 13·7	5	*i*
	9	−29 25·99	1	−36 22·5	1	*k*
		− 3 33·03	2	+17 31·6	2	*l*
	10	+ 2 11·99	6	− 5 28·7	6	*m*
	13	− 6 13·30	4	+ 0 24·9	4	*n*
	23	− 5 8·51	4	−21 37·8	4	*o*
	26	− 5 2·31	7	+11 44·6	7	*p*
	27	+ 5 42·19	4	− 0 32·1	4	*q*
	31	− 0 21·65	11	− 0 9·5	11	*r*
Aug.	1	+ 0 53·98	6	+14 2·6	6	*r*
	2	+ 5 25·25	6	+ 5 11·4	6	*s*
	6	+ 1 54·96	8	+ 4 32·4	8	*t*
	8	− 5 18·81	3	−25 49·5	3	*u*
	13	− 5 47·78	6	+ 0 51·3	6	*v*
	14	− 4 45·59	2	+ 9 27·1	2	*v*
	15	+ 1 48·85	8	+ 3 47·8	8	*w*
	16	+ 2 52·72	6	+12 10·9	6	*w*
	19	− 1 12·06	8	− 7 43·3	8	*x*

	R.A. Comet — Star.	No. of Comp.	N.P.D. Comet — Star.	No. of Comp.	Star.
d	m s		′ ″		
Aug. 20	+ 0 59·93	8	+ 3 45·8	8	*y*
21	+ 0 55·02	8	+ 6 54·8	8	*x*
23	+ 2 42·01	8	+ 3 30·7	8	*z*
24	+ 3 47·18	8	+10 17·3	8	*z*
27	− 4 51·96	6	+ 4 7·9	6	*a a*
28	− 3 44·16	6	+10 22·2	6	*a a*
30	+ 1 44·81	8	− 3 36·4	8	*b b*
Sept. 3	+ 2 3·92	6	−10 3·6	6	*c c*
6	− 1 9·31	6	− 9 53·5	6	*d d*
7	− 4 41·08	6	− 0 3·6	6	*e e*
9	− 2 16·69	6	+ 9 8·7	6	*e e*
10	− 2 37·66	6	+ 5 12·8	6	*f f*
11	− 1 24·66	6	+ 9 24·8	6	*f f*
12	− 0 6·93	8	+13 45·9	8	*f f*
13	+ 1 9·73	6	+17 48·5	6	*f f*
14	+ 2 22·62	6	+21 29·7	6	*f f*
23	− 2 36·92	4	−32 34·3	4	*g g*
Oct. 9	+ 1 46·87	8	− 1 15·5	8	*h h*
11	− 4 43·97	6	+ 6 7·8	6	*i i*
12	− 3 8·32	2	+ 6 13·0	2	*i i*
14	− 5 44·14	4	− 6 20·8	5	*k k*
15	− 4 16·15	6	− 6 40·4	6	*k k*
16	− 2 48·66	8	− 6 58·4	8	*k k*
23	+ 1 0·70	6	+13 15·6	6	*l l*
28	− 2 20·76	8	−10 55·2	8	*m m*
Nov. 1	+ 0 57·26	8	+ 6 18·9	8	*n n*
2	− 0 34·14	7	− 0 6·2	7	*o o*
	+ 2 40·55	2	+ 3 21·9	2	*n n*
5	− 2 47·38	8	+ 4 58·1	8	*p p*
6	− 1 9·64	7	+ 1 42·9	7	*p p*
7	+ 0 29·91	9	− 1 49·5	9	*p p*
9	+ 2 39·71	4	− 3 46·3	3	*q q*
11	− 0 48·10	9	− 9 12·8	9	*r r*
20	+ 1 1·34	8	+13 17·5	8	*s s*
23	+ 0 19·00	6	− 0 59·9	5	*t t*
27	− 0 15·83	8	+11 34·8	6	*u u*
28	+ 1 29·36	8	+ 5 4·7	6	*u u*
30	− 0 51·62	8	− 5 34·2	6	*v v*
Dec. 3	− 1 9·17	8	+ 4 43·9	6	*w w*
4	+ 0 39·79	8	− 2 41·7	6	*w w*
5	+ 2 27·53	8	−10 19·1	6	*w w*

The determinations of N.P.D. from July 2 to July 9, inclusive, are liable to some uncertainty, in consequence of the defective state of the clamp by

which the declination-rod was attached to the polar frame. The determinations of R.A., however, are trustworthy.

The R.A. and N.P.D. for July 2 are obtained by taking a mean between the results of the comparisons with (*c*) and (*d*).

It is probable that in the observation of Nov. 30 the recorded micrometer-reading was too great by 5 revolutions, and that the N.P.D. should consequently be diminished by $5^r = 43''{\cdot}2$.

Assumed Mean Places of the Stars of Comparison for 1861·0.

Star.	R.A. 1861·0. h m s	N.P.D. 1861·0. ° ′ ″	Authority.
a	6 46 15·02	43 33 14·32	Johnson 1841
b	6 52 29·36	43 51 2·00	Arg. 7473
c	8 41 53·41	27 31 18·42	Johnson 2212
d	8 38 36·47	27 39 33·30	Arg. 9299
e	10 7 54·05	24 12 1·81	Johnson 2464
f	9 39 26·98	23 45 44·11	,, 2396
g	11 49 16·42	23 58 58·28	Arg. 12183–84
h	13 45 13·86	27 48 58·73	Johnson 3103
i	13 15 17·63	27 52 18·45	Arg. 13563
k	14 4 27·81	30 0 10·61	Johnson 3147
l	13 39 6·75	29 9 18·43	,, 3084
m	13 45 40·92	30 46 16·61	,, 3104
n	14 19 21·88	33 47 26·83	Arg. 14545
o	14 51 46·18	39 48 7·45	Johnson 3293
p	14 56 52·21	40 15 20·75	Arg. 15039
q	14 47 39·45	40 45 27·01	,, 14924–5 and 6
r	14 59 12·46	41 48 11·30	Johnson 3318
s	14 55 54·28	42 10 19·81	,, 3306
t	15 4 1·33	42 59 22·55	Arg. 15138, 39 & 4
u	15 13 32·48	43 52 21·45	,, 15266
v	15 19 24·05	44 14 8·99	,, 15347
w	15 13 54·71	44 28 34·20	,, 15272
x	15 21 13·64	45 12 35·38	Johnson 3385
y	15 20 5·93	45 8 36·32	Arg. 15355
z	15 21 38·49	45 30 23·41	Johnson 3387
a a	15 33 40·19	45 56 27·99	,, 3423
b b	15 30 24·17	46 22 13·89	,, 3413
c c	15 34 45·30	46 51 5·65	,, 3431
d d	15 41 28·95	47 5 56·02	,, 3448
e e	15 46 14·48	47 0 57·43	,, 3462
f f	15 47 52·16	47 9 27·67	,, 3464
g g	16 4 37·39	48 32 30·79	H. C. 29530
h h	16 22 37·14	48 26 28·41	,, 30042
i i	16 32 3·53	48 19 43·04	Eq. Comparison.
k k	16 37 35·56	48 32 26·10	H. C. 30489
l l	16 44 32·00	48 5 41·91	,, 30687

Star.	R.A. 1861·0. h m s	N.P.D. 1861·0. ° ′ ″	Authority.
m m	16 55 43·43	48 21 7·36	H. C. 31031
n n	16 58 51·13	47 54 20·14	B. Z. 426. $16^h 57^m 41^s$
o o	17 2 5·02	47 57 47·50	Eq. Comparison.
p p	17 9 8·21	47 43 49·86	H. C. 31417
q q	17 10 20·85	47 38 5·93	,, 31456
r r	17 17 8·42	47 35 49·01	,, 31697
s s	17 30 28·18	46 30 36·13	,, 32154 and 5
t t	17 36 25·19	46 27 32·75	Johnson 3741
u u	17 43 54·58	45 50 48·38	,, 3763
v v	17 49 50·27	45 48 35·65	B. Z. 478. $17^h 47^m 53^s$
w w	17 55 25·32	45 16 31·59	Eq. Comparison.

The place assumed for the star (*i i*) is derived from equatorial comparisons made on Oct. 15 with H. C. 30489. The place of (*o o*) is derived from equatorial comparisons made on Nov. 20 with B. Z. 426. $16^d 57^m 41^s$, and the place of (*w w*) from equatorial comparisons with Johnson 3795 made on Feb. 20, 1862.

The observations up to July 13 were made by Professor Challis, and the subsequent ones by Mr. Bowden, the senior Assistant at this Observatory.

Cambridge Observatory,
April 25th, 1862.

Observations of Encke's Comet. By W. Scott, Astronomer for New South Wales.

(*Extract of a Letter to the Astronomer Royal, dated Observatory, Sydney, March* 22, 1862.)

"I send you herewith the only good observations I have been enabled to obtain of Encke's Comet. The weather has been cloudy or hazy for the last two months, and the Comet was, at the best, very indistinct and ill defined.

Observations of Encke's Comet with the 7-inch Equatoreal and Ring-Micrometer.

Greenwich M.T. d h m s	R.A. Comet — Star. m s	Decl. Comet — Star. ′ ″	Star.
Feb. 23 5 45 14	−5 37·7	+4 25	*a*
53 24	−1 37·8	−0 3	*b*
6 1 36	−1 36·3	−0 13	*b*
7 6	−1 35·7	+0 7	*b*
11 31	−1 36·0	+0 3	*b*
11 31	−5 35·1	+4 5	*a*

Stars of Comparison; *a*, B.A.C. 7216; *b*, 8th mag.
R.A. $20^h 38^m 22^s$; Decl. −25° 25′.

Greenwich M.T.	R.A. Comet — Star.	Decl. Comet — Star.	Star.
d h m s	m s	′ ″	
Feb. 24 5 43 26	−3 27·6	+5 24	*a*
49 14	−3 27·2	+5 17	*a*
56 6	−3 26·8	+5 29	*a*
6 3 6	+0 33·8	+0 58	*b*
9 40	+0 34·3	+1 2	*b*
12 2	+0 34·2	+0 53	*b*

Stars of Comparison same as before.

Results of Meridional Observations of Small Planets; Occultation of a Star by the Moon; and Phenomena of Jupiter's Satellites; observed at the Royal Observatory, Greenwich, during the month of April, 1862.

(*Communicated by the Astronomer Royal.*)

Flora (8).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1862, April 3 13 14 50·6	14 3 15·27	92 22 40·99
15 12 16 16·5	13 51 50·22	91 11 5·40
17 12 6 25·2	13 49 50·40	91 0 4·04
21 11 46 42·2	13 45 50·39	90 39 16·90
22 11 41 46·9	13 44 50·87	90 34 27·76
24 11 31 57·4	13 42 52·80	90 25 6·09
26 11 22 9·5	13 40 56·38	90 16 17·62
28 11 12 23·8	13 39 2·26	90 8 8·48
30 11 2 41·1	13 37 11·04	90 0 35·02

Melpomene (18).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1862, April 22 13 11 57·5	15 15 16·28	92 28 42·64
29 12 38 18·2	15 9 7·30	91 43 32·50

Fortuna (19).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1862, April 17 9 55 53·5	11 38 57·33	88 47 7·61
21 9 38 10·4	11 36 57·47	88 31 21·76

Thalia (28).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1862, April 3 9 32 13·4	10 20 1·57	62 11 46·71

Euterpe (27).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1862, April 3 12 49 26·1	13 37 46·66	97 26 2·94
17 11 40 56·1	13 24 17·12	96 9 42·67
21 11 21 29·1	13 20 33·19	95 49 26·26
24 11 7 0·5	13 17 51·80	95 35 0·59
25 11 2 12·6	13 16 59·70	95 30 24·92
28 10 47 55·0	13 14 29·45	95 17 23·52
29 10 43 11·2	13 13 41·41	95 13 15·87

Amphitrite (29).

Mean Solar Time of Observation.	R.A. from Observation.	N.P.D. from Observation.
h m s	h m s	° ′ ″
1862, April 17 9 45 9·8	11 28 11·83	87 59 18·66
21 9 27 35·5	11 26 20·87	87 54 55·24
23 9 18 57·3	11 25 34·38	87 53 30·20
28 8 57 48·1	11 24 4·40	87 52 13·47
29 8 53 38·8	11 23 51·06	87 52 26·30

All the observations of N.P.D. have been corrected for refraction and parallax.

The reappearance of B.A.C. 4923, on 1862, April 15, at the Moon's bright limb was observed by Mr. Criswick to take place at $13^h\ 50^m\ 34^s{\cdot}7$ G.M.T.

Phenomena of Jupiter's Satellites.

Day of Observation. 1862.	Satellite.	Phenomenon.	Mean Solar Time.	Observer.
			h m s	
April 15	I	Egress, bisection	13 58 48·6	C.
15	I	,, last cont.	14 0 18·3	C.
17	I	,, bisection	8 25 25·1	J. C.
22	I	Ingress, bisection	13 29 58·8	E.
24	I	Egress, bisection	10 12 7·9	D.
24	I	,, last cont.	10 15 7·4	D.
25	I	Eclipse, reapp.	8 17 55·3	J. C.
25	II	Eclipse, reapp.	11 11 55·0	J. C.

The initials D., E., C., and J. C., are respectively those of Mr. Dunkin, Mr. Ellis, Mr. Criswick, and Mr. Carpenter.

Ephemeris of Proserpine (26). By M. Hoek, Director of the Observatory of Utrecht.

(*Letter to the Astronomer Royal, dated Utrecht, 1862, May 20.*)

"J'ai l'honneur de vous adresser une éphéméride pour l'opposition prochaine de *Proserpine* (26), éphéméride qui a été déduite par interpolation, du Jahres-éphéméride dans le *Berliner Astronomisches Jahrbuch für* 1864, et qui a déjà été corrigée (d'après l'indication de M. Kam à Leÿde) par -3^s en R.A., et $0'{\cdot}0$ en Decl.

"Monsieur Kam a eu la complaisance de chercher la planète, de sorte que vous la trouverez aux endroits suivantes:—

T.M. de Berlin. 1862.	R.A. h m s	Decl. ° ′	Log Δ.	Temps de Transmission de la Lumière. m s
Mai 25·5	17 29 32	−26 15·3	0·1628	11 57·5
26·5	28 42	16·6	·1618	55·7
27·5	27 50	17·8	·1608	54·0
28·5	26 58	19·0	·1598	52·4
29·5	26 4	20·2	·1589	51·0
30·5	25 9	21·4	·1581	49·7
31·5	24 13	22·5	·1573	48·5
Juin 1·5	23 17	23·5	·1567	47·4
2·5	22 20	24·5	·1561	46·5
3·5	21 23	25·3	·1556	45·7
4·5	20 25	26·1	·1552	45·0
5·5	19 27	26·9	·1548	44·5
6·5	18 28	27·5	·1546	44·1
7·5	17 29	28·1	·1544	43·8
8·5	16 29	28·7	·1543	43·6
9·5	15 29	29·2	·1543	43·5
10·5	14 29	29·6	·1543	43·5
11·5	13 29	30·0	·1545	43·7
12·5	12 29	30·3	·1547	44·0
13·5	11 30	30·5	·1549	44·5
14·5	10 31	30·6	·1553	45·2
15·5	9 33	30·7	·1557	46·0
16·5	8 35	30·7	·1563	46·9
17·5	7 37	30·7	·1569	47·9
18·5	6 40	30·7	·1575	49·0
19·5	5 44	30·6	·1583	50·1
20·5	4 48	30·4	·1591	51·4
21·5	3 53	30·2	·1600	52·8
22·5	2 59	29·9	·1610	54·4
23·5	2 5	29·5	·1620	56·2
24·5	17 1 12	−26 29·1	0·1632	11 58·2

"Si vous vouliez communiquer cette éphéméride aux astronomes Anglais qui pourraient s'y intéresser, vous m'obligeriez fort."

Further Note on the supposed Observation of an Intra-Mercurial Planet on the 12th of February, 1820.

Mr. Carrington has been favoured with the following letter from Dr. von Littrow, which he hastens to communicate a translation of, referring at the same time to the *Monthly Notices*, vol. xx. p. 194.

"*Vienna, April 13th*, 1862.

"A fortunate chance has, at length, led me to-day to a source whence I have obtained further information respecting the observation of Steinheibel.

"In the Vienna *Times* of April 27th, 1820, there is to be found the following notice, communicated probably by my father:—

"'Mr. Steinheibel, who for the last four years has daily observed the Sun and recorded his spots and faculæ with care in a diary, on February 12th (1820), at $10^h 45^m$ in the morning, observed a spot, which was distinguished from all the rest by its well-defined circular form, by its equally circular atmosphere, by its orange-red colour, and especially by its unusual motion, completing the diameter of the Sun in nearly five hours. As he made this interesting observation during a country excursion, it was impossible to have recourse to instruments or to communicate the phenomenon early enough to others; yet he is ready to answer fully every question put to him about this occurrence. It is very possible that a planet might be discovered in this way, having its orbit within that of *Mercury*; and should the zeal with which Mr. Steinheibel has pursued this class of observations for a series of years, be rewarded by such a happy result, and lead him to publish his observations on the Sun, they would not be without interest for the public.'

"I have in a former letter incorrectly written the name 'Steinheibel,' according to Olbers, 'Steinhübel.' He lived for some time as Abbé at Vienna, and subsequently at Kremsmünster; at both of which places he occupied himself continuously with observations of the Sun. The above observation of his is given so differently to that of Starke, that I should consider it independent of the latter."

Mr. Lassell writes to correct an error (p. 164 of the *Monthly Notices*), where it is stated that the new star discovered by him within the trapezium of the great nebula of

Orion "appears to be about a full magnitude less than that known as 'the sixth star;' and is about one-sixteenth of its distance from *Theta*." Mr. Lassell's note at the time in his journal states "about five-eighths of the distance of the sixth star from *Theta*." On referring to his original communication, it appears that the distance there mentioned was *six-tenths*, which was inadvertently printed as *one-sixteenth*.

On the Missing Nebula in Coma Berenices. By M. Chacornac.

(*Extract of a Letter to Sir J. Herschel, dated Paris, 22d May*, 1862.)

"Permettez moi de vous adresser quelques renseignements sur la nébuleuse variable dont vous annoncez la disparition dans le No. 6 du xxii^{me} volume des *Monthly Notice*.

"Le 19 Avril dernier, ayant dirigé le grand téléscope de M. Foucault sur la région du ciel environnant l'étoile (6) de la constellation de la chevelure de *Bérénice*, dans le but d'étudier la structure des nébuleuses qui s'y trouvent condensées; j'y remarquai une nébuleuse double dont l'une des deux composantes avait un éclat bien plus faible que l'autre, ce qu'il était facile d'apprécier par leur visibilité dans le même champ de vue.

"En dirigeant de nouveau le même instrument sur le lieu que vous désignez, j'ai reconnu que les trois nébuleuses cataloguées se trouvent à peu près à leur place respective que vous indiquez. Les deux objets (A) et (B) sont bien de première classe et une étoile de dixième à onzième grandeur précède bien la nébuleuse (B) de 24^s, mais je trouverais une différence d'ascension droite moins grande entre ces deux objets, c'est à dire:—

$$\text{R.A. (B)} - \text{R.A. (A)} = 13^s{\cdot}5.$$

"La troisième nébuleuse peu éloignée de (B) est bien celle que j'ai aperçue le 19 Avril; elle répond assez bien aux différences que vous annoncez mais elle brille d'un faible éclat. Sa constitution analogue à celle de (B) m'a permis de comparer son intensité lumineuse à celle de cette nébuleuse au moyen d'un micromètre à double image appliqué au téléscope; j'ai trouvé ainsi la lumière du compagnon quatre fois plus faible que celle de la nébuleuse principale (B)."

Mr. Rümker has presented to the Society the manuscripts containing his Observations of Southern Stars made at Paramatta in the years 1826 and 1827. The thanks of the Council were voted to him for this valuable gift.

On Heliotypography. By Warren De La Rue, Esq.

The accompanying print of Sun-spots was produced from a collodion negative, taken by means of my Newtonian reflector of 18 inches aperture and 10 feet focal length, on the scale of 3 feet for the Sun's diameter.

The original focal image was enlarged before reaching the sensitive plate from about 1 inch in diameter to the scale of the picture, by means of a new combination of lenses which projects the image without sensible distortion on a flat field, and whose visual and chemical foci coincide perfectly.

The camera which is attached to the eye-end of the telescope will hold a plate 18 × 18 inches, so that about one-fourth of the Sun can be depicted at one time. Even for a picture of such a size, the apparatus is very heavy, and could not be carried safely at one end of the tube, unless a provision had been made to support it. This is effected by means of a radius bar, which moves on a short independent axis, fixed on the framing of the telescope, in the prolongation of the polar axis.

When Sun-pictures are taken, the telescope tube is for convenience rotated in its cradle through an arc of 90° from its ordinary position, so as to place the eye-piece underneath. To the sliding tube which carries usually the eye-piece, is fixed the instantaneous apparatus, which moves in a direction at right angles across the tube. The moveable plate of the instantaneous apparatus slides as nearly as possible in the plane of the primary focal image.

The enlarged image is received at a distance of about 4 feet from the secondary magnifier.

The printing block was produced by M. Paul Pretsch, according to a method he has invented. The process may be rendered sufficiently clear without revealing the exact process, which he does not wish to disclose at present.

Gelatine is mixed with a salt of chromic acid, such as bi-chromate of potash, and poured on to a glass plate, and allowed to dry in the dark. If a plate so prepared is exposed to light, and a similar plate is retained in the dark, and the two plates are subsequently moistened with water, it will be found that the gelatine which has not been exposed to the

SUN SPOTS.

TAKEN AT CRANFORD WITH THE 13-INCH REFLECTOR, 1861, SEPT. 24TH, 2H. 15M.

Printed at the ordinary Typographical Press from an Electro-copper Block, obtained from the original Negative by means of Light and Electro-metallurgy.
Absolutely untouched by the Graver.

action of the light will swell up like ordinary gelatine, while that which has been exposed to light will have become changed, and will remain unacted on by the water.

If, therefore, an ordinary negative be placed over the dry prepared film of gelatine, and both are submitted to the action of light, the gelatine will become more or less changed in proportion to the intensity of the light transmitted through the several parts of the negative. For example, in the case of a negative of a Sun-spot, much light will pass through the image of the spot, less through that of the penumbra, and still less through that of the bright parts of the Sun's surface, and the light so transmitted will produce a corresponding hardening of the prepared surface.

When therefore the plate is subsequently moistened, the part corresponding to the spot will remain flat, more or less in proportion to the intensity of light which has acted on it, the bright parts will swell, and the gelatine film will represent the matrix of a surface-printing block.

It is now only necessary to obtain, by means of known processes in electro-metallurgy, a counterpart of the gelatine. The plate so prepared is the printing block, which will furnish many thousand impressions at an ordinary printing-press, it being however necessary from time to time to clear the block, which is liable to become clogged on account of the want of depth in the light parts. On observing the impression at a little distance from the eye, a sort of mottling will be perceived on the bright parts of the picture; this is a true representation of the Sun's surface; on the other hand, an examination of the picture by means of a magnifier will show a vermicelli sort of granulation, which does not belong to the Sun, but results from the process and arises from the change which takes place in the gelatine film passing as it were from the gelatinous or dynamic condition to the crystalline or static condition of matter.

The grain may be made coarser or finer, and need in no way interfere with a picture more than the lines of a steel plate or the grain of a lithographic stone interferes with pictures engraved on the first or drawn on the second.

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